National Lumber Manufacturers Association

Engineering Bureau

925 Lumber Exchange, Chicago, Ill.

TECHNICAL LETTER No. 4 AUGUST, 1916

BUILDING CODE SUGGESTIONS

Fire Stops, Careful Workmanship, and Proper Selection of Materials As Safeguards in Frame Dwelling Construction

Knowledge of proper design and reliable information as to the selection and use of building materials are essential factors in safeguarding American homes against damage and loss by fire. City ordinances dealing with building construction may improve conditions or retard development, according to the soundness of their provisions. Enlightened public sentiment and personal responsibility should be the foundation on which building codes are drawn. Agitation and propaganda which are to fully serve the public interest should be neither hysterical nor selfish, and should reconcile as far as possible the many conflicting interests represented by building material producers and property owners. An advanced step towards safeguarding life and property against fire will have been taken when building ordinances properly safeguard the dwelling house, and recommendations and provisions to this end are of special interest to those who produce, distribute or use wood.

From the standpoint of the lumber industry it is recognized that:—

Dwellings are usually the least protected of any class of buildings, and when of flimsy, improper construction constitute an unnecessary hazard.

Wood in such cases is condemned, when actually the fault is not with the material, but with the careless construction and disregard of the fire hazard.

The cost of proper construction in relation to the fire hazard adds only a small percentage to the total cost of the dwelling; yet gives returns in lower insurance rates, and greater safety far in excess of the additional expense.

Intelligent selection of lumber to insure the proper kind and grade for the particular locations or different parts of a structure, is essential.

With proper selection should come the consideration of strength of the different kinds of timber. In all cases careful workmanship in framing and placing is necessary.

A consideration of great importance is proper firestops or fire barriers in dwelling house construction. This is one of the actual protective measures which is not as generally known or recognized, but fully as important as safe chimney, smokepipe, and fireplace construction.

Frame dwellings are the most common type, and are not only represented by the millions of existing homes, but will continue to be built in the indefinite future. This is true for both economic and sentimental reasons. Wood remains the least expensive, most universally available, and the most adaptable material. At the same time it responds to architectural treatment in a way which introduces a strong appeal on the ground of beauty and sentiment.

The greatest progress towards fire protection will be made by incorporating in our ordinances and building codes proper safeguards, and by educating the people to the necessity of proper construction. To attempt to legislate wooden buildings out of existence is uneconomical and not the solution. Rather than this, simple and inexpensive safeguards which will not place an unreasonable burden on the builder, should be provided.

The National Board of Fire Underwriters of New York has made such valuable recommendations regarding dwelling houses in its recently issued pamphlet, "Dwelling Houses—A Code of Suggestions for Construction and Fire Protection" that permission has been obtained to reprint extracts from their recommendations. The author of this pamphlet is Ira H. Woolson, the Board's Consulting Engineer. In acknowledging this authority and submitting this information for the benefit of the lumber industry, it is felt that not only the National Lumber Manufacturers Association, but producers and dealers generally will appreciate the sound, logical suggestions which have been made for the better and safer use of wood as a building material. It is unquestionably the duty of the lumber industry to impress on the prospective builder and the consuming public the essential facts relative to building codes and safe dwelling house construction. This reprint gives an opportunity to do this.

(Extracts from "Dwelling Houses—A Code of Suggestions for Construction and Fire Protection" Recommended by the National Board of Fire Underwriters)

Section 54. The Necessity for Fire-Stopping, and Suitable Materials to Use.

1. No one feature of house construction will contribute more to its safety in case of fire than efficient well placed firestops. Their purpose is to delay the spread of fire and so assist in confining it to the story in which it starts. This protects life, and affords a better chance of extinguishing the fire.

2. Fire-stops are principally applicable to non-fireproof buildings, such as Types III and IV,* though they should be used in any type of building where openings exist which would act as flues to distribute heated air or gases from a fire in one part of a building to other portions where they might ignite combustible material. The added cost of such protection is very slight, and yet its value is so little appreciated, the ordinary dwelling either has no fire-stopping at all, or else the work is so indifferently done as to be practically worthless. Because such work does not show when a building is completed, and because its importance is usually entirely underestimated, it is common to delegate it to a boy, or some careless incompetent person. The result is that the fire-stop is so in name only; it being merely a delusive imitation which if called upon to fulfill its purpose, fails completely. Such work does not call for any high degree of mechanical skill, but it is absolutely necessary that it be done by an intelligent conscientious workman if it is to be efficient.

3. The danger resulting from careless workmanship is greater in the construction of wooden fire-stops than when incombustible material is used. The reason for this is, that as the spaces between studs and joists vary somewhat, and as odd ends of timber are used for the purpose, it often happens that the opening supposed to be filled is really not completely closed. There will be a space of one-fourth to one-half inch due to a stop-piece happening to be that much short of the correct length, but which is considered "good enough" for the purpose. Another cause for openings at the ends, is that if the end of a stop-piece is not square, a careless person will consider it too much trouble to saw it to fit; or a stud or

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*TYPE III.

Buildings with walls of incombustible construction, but having all interior construction, including the roof, of wood. The roof covering being either wooden shingles or some type of fire-resistive material. The walls of such buildings are either stone, brick, concrete or terra cotta. Usually generous wooden piazzas are attached.

TYPE IV.

Buildings constructed entirely of wood, either with or without fire-resistive roof covering. Sometimes the walls are veneered with brick, or covered with stucco.

joist may be warped, or not set squarely, and unless the stop-piece is carefully fitted an opening will be left. The same defects exist at the sides of the stop-pieces, and as all such joints are sure to widen somewhat due to shrinkage, it is extremely important that such fire-stopping be snugly fitted. If wooden fire-stopping be used for walls or partitions, an intermediate stop shall be placed between the studs midway between floor and ceiling.

4. Incombustible fire-stopping material, such as mineral wool, concrete, or mortar, is soft when used, and is more or less tamped or pressed into the space prepared for it. This usually forms tight joints on all sides, even though the work be indifferently done. Material similar to mineral wool which is packed in place and does not harden will have a tendency to expand and fill any space that may later be formed by the shrinkage of the timber, which is an advantage. The necessity for having tight joints is to prevent the passage of air or gases which have been heated to the point of combustion.

Note: When a fire has heated the air and gases in a room to the temperature of combustion, they will pass through a very small opening and ignite any combustible material they touch. If such gases are under pressure, as is usually the case in a fire, the danger is increased. It must be understood that air or gases heated to the point of ignition of wood—which is less than 1,000 degrees F.—even though they carry no flame and are invisible, will set fire instantly to practically everything combustible with which they come in contact.

5. For reasons already explained, it is urged that incombustible fire-stopping materials be employed wherever possible. Their use not only lessens the chances of defective workmanship, but as they are unburnable themselves, the possibility of a fire getting by them is considerably decreased. There are places, however, where wooden fire-stopping is permissible. These will be discussed later.

6. There is a variety of materials which make excellent fire-stopping, such as brickwork, stone or cinder concrete, gypsum block, mineral wool or any incombustible material which, when packed into a space, will form a united mass that will not fall out through holes that might be made in the woodwork supporting it. Strips of metal lath can often be advantageously used to hold mortar or plaster until it sets. Some of these materials are nearly always found as waste products about a new building; their use involves no expense except for labor, and the disposal of refuse is an advantage.

7. When fire-stopping is made of brickwork, almost any sort of bricks will serve the purpose, such as second-hand, underburned, chipped, broken, or other defectives, providing sufficient mortar be used to fill all joints and interstices.

Note: As wooden studs are only about 3⅝ inches wide, the spaces between them are not wide enough for ordinary brick to be laid flatwise. Therefore in fire-stopping a stud wall it will be necessary to lay the brick on edge on the inner line of the fire-stop and fill the space between the brick and the sheathing with mortar; or use some other incombustible material. When fire-stopping a partition resting on a girder or the cap of a partition below, the bricks can be laid flatwise up nearly to the floor level, and then be laid edgewise with sufficient mortar on the side or sides to fill the space in the partition.

8. Concrete or mortar fill for fire-stopping can be made from any refuse from plaster, masonry, or concrete work. Even if such material has set, it can often be broken up, and by adding sufficient fine material to fill voids, enough cement or lime to produce a set, and water sufficient to form a plastic mass, it will make a very satisfactory fire-stopping material. Cinder concrete is also good.

9. Mineral wool is a superior material for fire-stopping. As previously explained it is especially adapted for places where it is necessary for the stopping to yield as the timbers shrink; also in places where its light weight is advantageous.

10. Solid gypsum blocks are excellent for fire-stopping in dry locations. They can be purchased the correct size to fit between studs, or ordinary partition blocks can easily be sawed to fit any space. It is important that any loose joints in such material should be filled with mortar. Such blocks will also yield when wood shrinks and throws pressure upon them.

Note: Gypsum products, such as gypsum blocks, or so-called "plaster blocks" or "cinder plaster blocks," also plaster board, absorb moisture freely, and when wet they lose considerable of their strength. They should not be used in contact with wet surfaces, or where likely to become water soaked. Fire-stopping which remains damp is liable to induce dry rot in adjoining woodwork. Gypsum products are also liable to deteriorate when subjected to temperatures in excess of 200 degrees Fahr. for considerable periods of time. They should not be used where such unusual temperatures prevail.

11. Asbestos mill board, gypsum plaster board, or metal lath and plaster, are useful fire-stopping materials where considerable areas must be covered, such as a cellar ceiling or as the lining of the pocket for a sliding door. They are not recommended for the ordinary stopping of walls or partitions.

12. Aside from its great value in resisting the spread of fire, incombustible fire-stopping serves the very useful purpose of preventing the travel of rats or mice through a house, and aids in resisting the transmission of sounds.

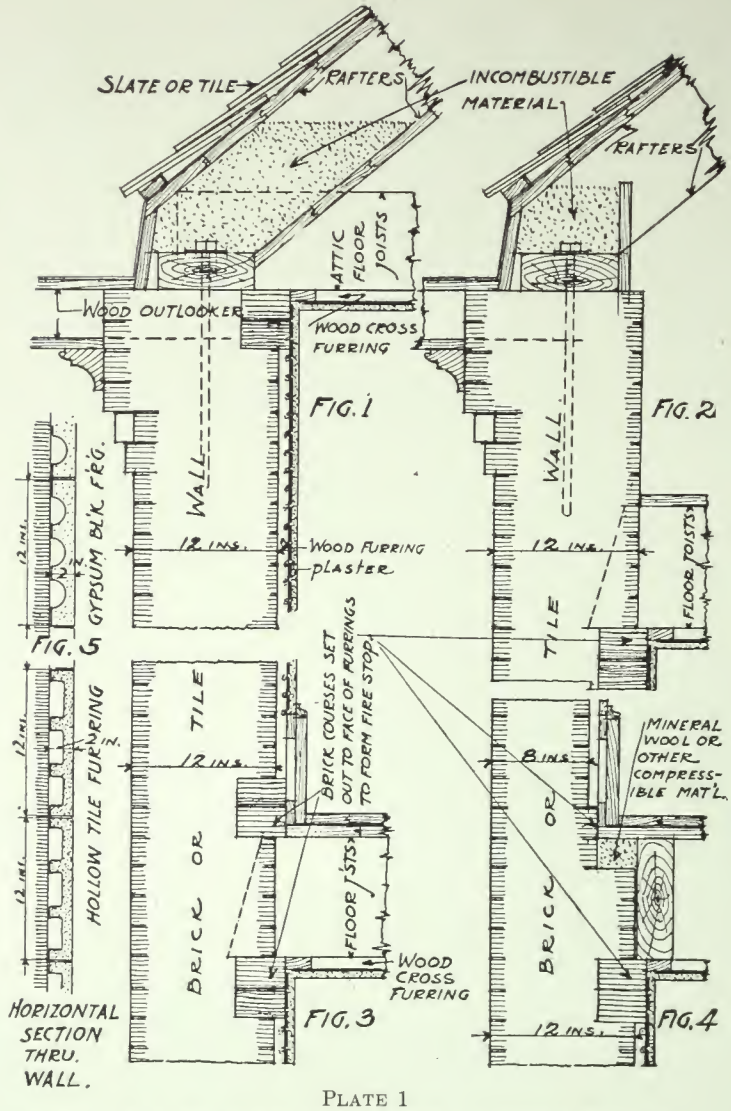


PLATE 1

DWELLINGS WITH WALLS OF BRICK OR OTHER MASONRY.

Fig. 1.—Method of fire-stopping at eaves when attic floor joists are level with plate.

Fig. 2.—Same as Fig. 1, except that attic floor joists are any distance below the plate and built into the wall. Support for fire-stopping might be same as in Fig. 1 if more convenient.

Fig. 3.—In this and the other figures of this plate note fire-stopping of wooden furring by two courses of brickwork being set out to face of furring above and below floor joists all around the building. Other types of masonry walls should be built out in the same manner.

Fig. 4.—Fire-stopping at a floor level when the wall is thinner above the floor than below.

Fig. 5.—Terra cotta and gypsum block wall furring.

Note.—The first course above each floor shall either be solid blocks or the hollow spaces be filled with mortar.

Section 55. Construction of Fire-Stopping.

1. Fire-stopping shall be arranged to cut off all concealed draft openings, and form an effectual horizontal fire barrier between stories. Open passages in frame walls or partitions are a prolific cause for rapid spread of fire to all parts of a structure. If fire occurs in the cellar or basement, they act as flues to carry it to the attic. If the fire starts in the attic the sparks fall down the hollow spaces. Results are disastrous in either case.

2. **Furred Walls.** For all walls furred with wood the masonry between the ends of wooden beams shall project the thickness of the furring beyond the inner face of the wall for the full depth of the beams; or a double course of bricks or other masonry above

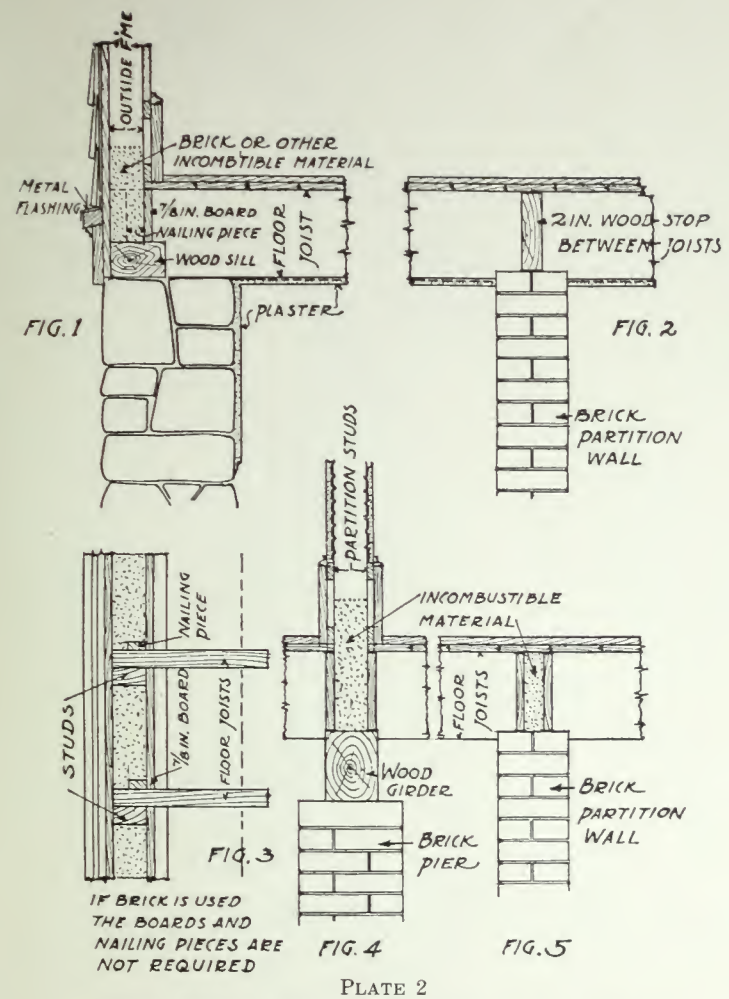


PLATE 2

Figs. 1 and 3.—Elevation and plan showing fire-stopping of wall of frame building at line of sill and between studs and floor joists.

Fig. 2.—Fire-stopping with timber cut between floor joists on top of brick partition.

Fig. 4.—Fire-stopping of partition resting on wooden girder.

Fig. 5.—Same as Fig. 2 except that incombustible compressible material between two boards is used instead of a timber.

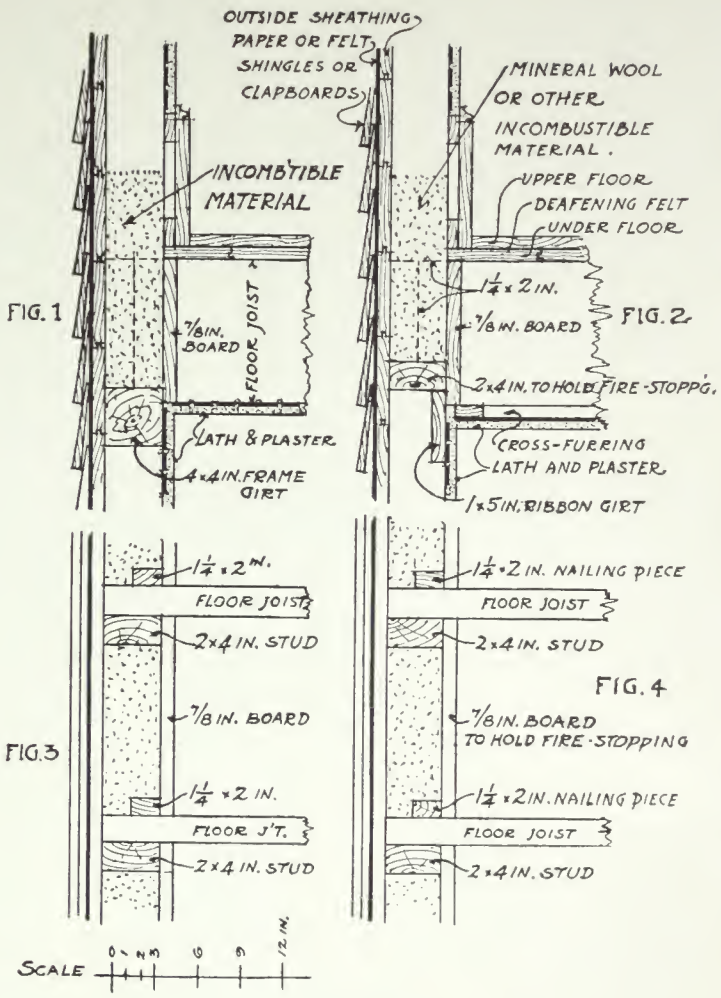


PLATE 3

Figs. 1 and 3.—Elevation and plan showing fire-stopping in frame wall at connection of upper floor joists with girt.

Figs. 2 and 4.—Fire-stopping at same place for "balloon frame."

and below the beams shall project beyond the face of the wall the full thickness of the furring. Plate 1. Such fire-stopping in hollow block walls is usually obtained by using 1-inch slabs of the same material, the slabs serving also as the bearing course for the floor joists. Where floor beams are parallel to a wall furred with wood, there shall be a space of not less than 2½ inches between such wall and the nearest beam. This space shall be filled in solidly with brickwork or concrete for the full depth of the floor beams, or be equivalently fire-stopped.

Note: Two courses of brick, slabs, or other masonry, are required to cut off a furring space, for mortar joints may drop out of a single course and render it useless.

Incombustible furring is excellent since it entirely prevents a fire creeping along a wall from one story to another behind the plaster. Terra cotta or gypsum furring blocks or tile are much used and are quite satisfactory. They have a series of grooves in the back face which affords the necessary air space between the wall and the plaster. Plate I, Figs. 4 and 5. There are also several styles of metal furring strips to which metal lath is attached, and so serve the same purpose. Where walls are likely to be damp, terra cotta furring would probably be most satisfactory. All these forms of furring should be fire-stopped with mortar a few inches at the bottom to prevent possibility of their acting as flues for heated gases and bringing them in contact with wooden construction in the floor above.

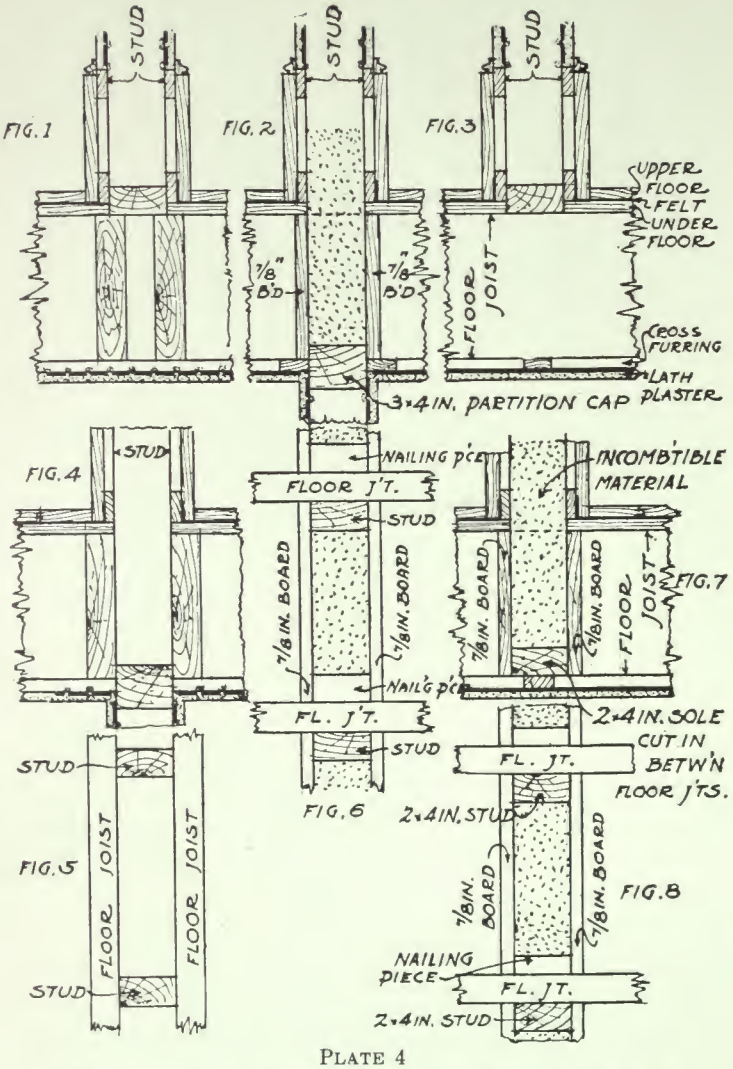


PLATE 4

Fig. 1.—Interior partition running same direction as floor joists supported on double joists, fire-stopped at bottom by 2 x 4 inch sole.

Figs. 2 and 6.—Elevation and plan of partition footing on 3 x 4 inch cap of partition below running crosswise to joists, showing method of fire-stopping between joists.

Fig. 3.—Partition running crosswise to floor joists footing on sole used as a fire-stop. This would be improved by addition of some incombustible material on top of sole.

Figs. 4 and 5.—Elevation and plan of partition running same direction as floor joist footing on 3 x 4 inch cap of partition below used as fire-stop, and floor joist placed alongside studs.

Figs. 7 and 8.—Elevation and plan of partition running crosswise to joists footing on sole fitted between joists at bottom and fire-stopped with mineral wool between two boards. Brickwork or other solid incombustible material could be used.

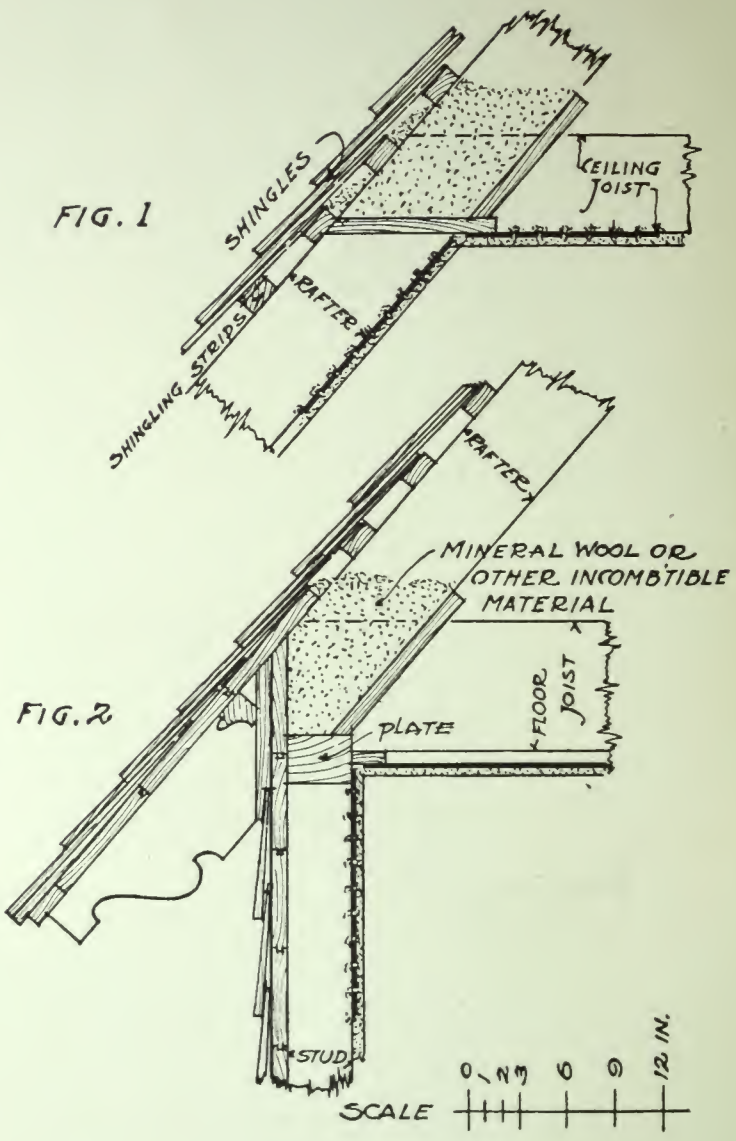


PLATE 5

Fig. 1.—Connection of attic ceiling joists was roof rafters, fire-stopping supported on boards fitted between rafters and ceiling joists. This protects space above ceiling often used for storage.

Fig. 2.—Connection of floor joists with outside frame at plate level, showing "open rafter end" cornice, and fire-stopping supported on boards cut between joists.

3. **Walls Studded-Off.** Where walls are studded-off, the space between the inside face of the wall and the studding at the floor level shall be fire-stopped with incombustible material. The beams directly over the studded-off space shall be deadened with not less than 4 inches of incombustible material, which shall be laid on boards cut in between the beams; or better still, use 4-inch solid gypsum plaster blocks cut to fit the space between the beams and supported by cleats, thus avoiding the board supports. The under side of such beams shall be protected by a covering of metal lath or plaster board, and plastered to a total thickness of ¾ inch, or a double layer of ¼-inch asbestos mill board with broken joints.

4. **Frame Walls.** In frame buildings which are to be lathed and plastered or otherwise sheathed on the inside, all stud walls shall be completely fire-stopped with brickwork or other

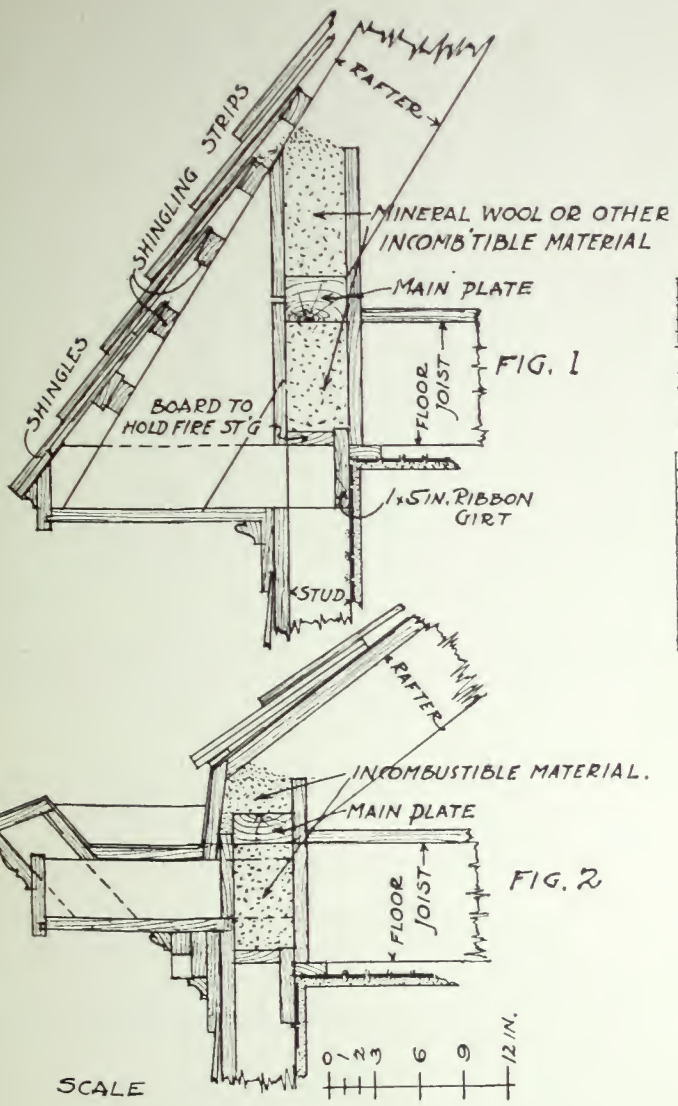
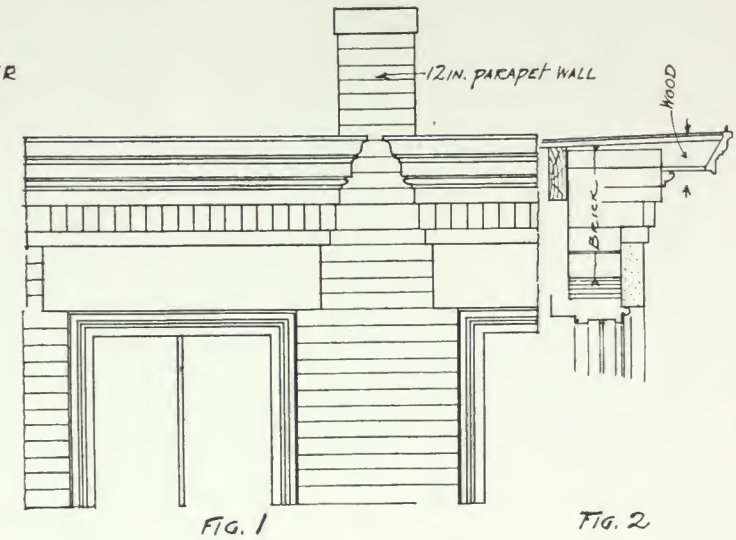


PLATE 6

Fig. 1.—Connection of floor joists with outside "balloon" frame. Method of fire-stopping cornice and "gambrel" roof construction.

Fig. 2.—Connection of floor joists with outside "balloon" frame at plate level, showing "box" cornice, gutter trough, and foot of roof rafters, and method of fire-stopping. This retards fire entering building if cornice burns. Same methods employed for girt framing.



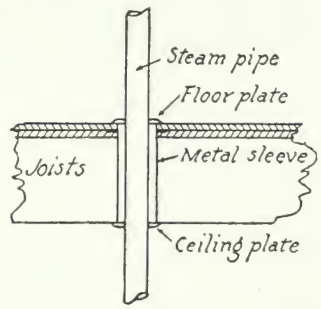


PLATE 7

Figs. 1 and 2.—Elevation and section of wooden cornice on a brick wall. Note separation of cornice on line of party wall.

Fig. 3.—Protection of pipe opening through floor or partition.

suitable incombustible material at each floor level. The spaces between the studs shall be filled to a height of 4 inches above the floor level. Plates 2 and 3. For protection of frame walls with severe exterior exposure, see Section 58.

5. **Partitions.** Where stud partitions rest directly over each other and cross wooden floor beams at any angle, they shall run down between the floor beams and rest on the top plate of the partition below, and shall have the spaces between the studding filled in solid to at least 4 inches above each floor level with approved incombustible materials.

Methods for fire-stopping various forms of partition construction are shown in Plates 2 and 4. While incombustible material only is recommended for fire-stopping, it may not always be practical to require it; therefore in some cases the sketches indicate methods for placing both incombustible and wooden fire-stopping, but incombustible material should be used wherever suitable.

There are some places in wooden construction, such as a fire-stop along the top of a brick partition over which a floor is laid in the story above, see Plate 2, Figs. 2 and 5, where

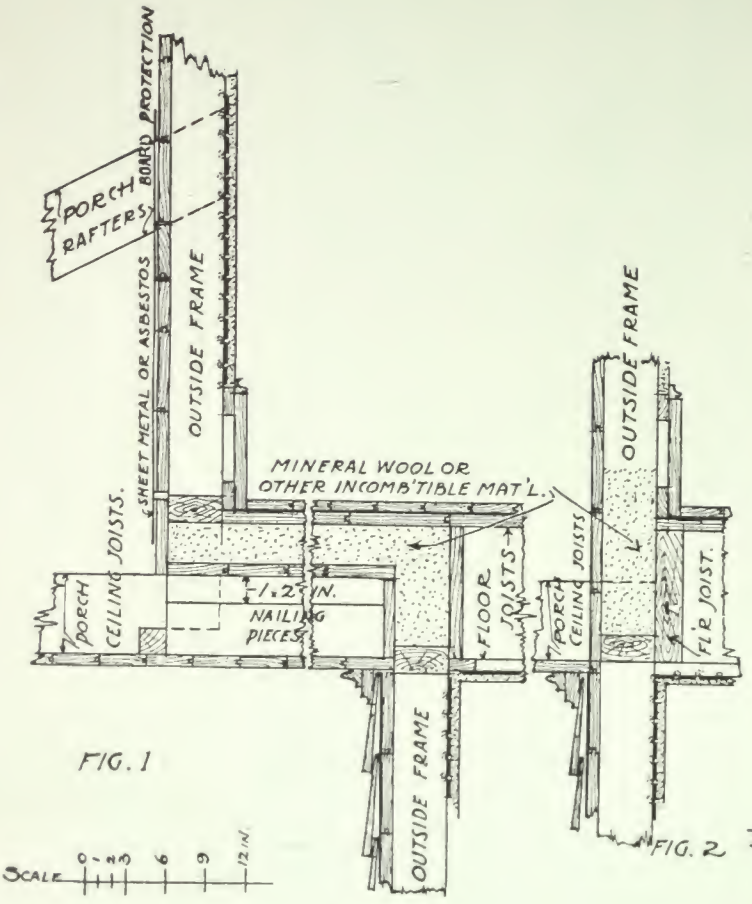


PLATE 8

Fire-stopping over piazza roof. See Section 35, par. 10.

Fig. 1.—Section through an outside frame overhanging at second floor level, with ceiling joists and rafters of a piazza framed into it. Method of fire-stopping over ceiling joists, also for outside of frame wall under porch.

Fig. 2.—Section through a flush frame with piazza ceiling joists finished against it, and method of fire-stopping. Wall above should be protected as indicated in Fig. 1.

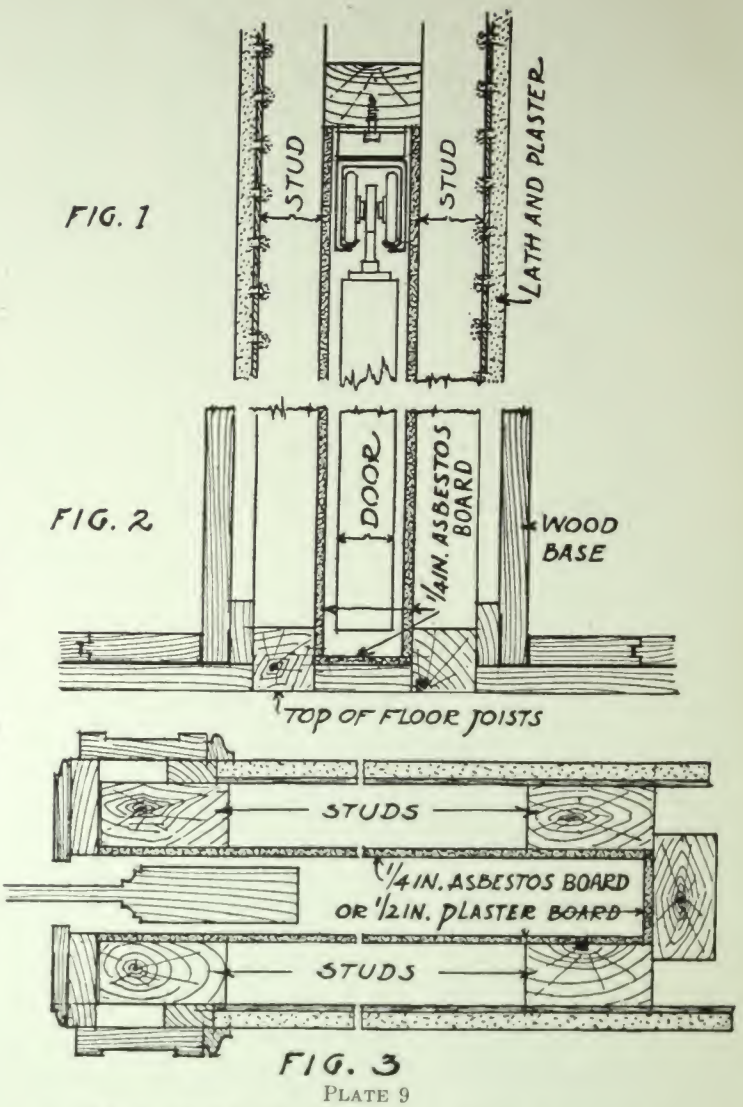


PLATE 9

Fig. 1.—Section through head of sliding door pocket in a stud partition, showing method of fire-stopping.

Fig. 2.—Section through pocket at floor.

Fig. 3.—Section plan through pocket.

wooden fire-stopping, or a compressible incombustible material, such as mineral wool must be used, otherwise the shrinkage of the timber construction will in time cause the floor to bulge. A course of brickwork resting on the foundation wall and built between the ends of joists, is a method of fire-stopping frequently recommended as an addition to a wall stop such as shown in Plate 2, Figs. 1 and 3. Such brickwork if built snugly against the underside of the floor, as it should be, is likely to deform the floor when the timber shrinks. If the wall stopping is effectively done with incombustible material, it is doubtful whether such secondary stop is necessary.

If the location is dry, and an additional fire-stop is desired, gypsum partition block would serve the purpose well, or it may be made of asbestos board, or metal lath and plaster might be used. A wooden board could be used, but is not so good as incombustible material. Such a stop in an existing building in which the timber had practically ceased to shrink, could be constructed of brickwork without objection.

6. **Floors.** See Section 38, pages 10 and 11.

7. **Roofs.** Dwellings within 10 feet of other non-fireproof buildings, shall have the walls behind eaves or cornices fully fire-stopped to prevent fire from a nearby building breaking through into the attic space. Such fire-stopping will also protect against fire which

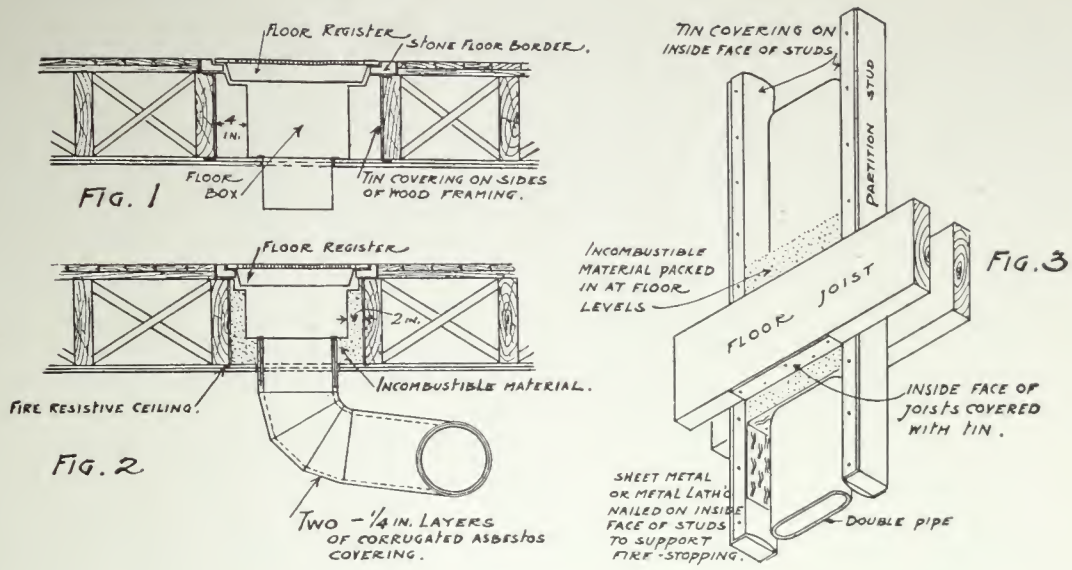


PLATE 10

Fig. 1.—Method of fire-stopping around floor register. Note register box extended to line of ceiling which simplifies installation.
Fig. 2.—A more complete method of fire-stopping, and one well suited for existing buildings.
Fig. 3.—Isometric sketch showing method of fire-stopping between floor joists around a hot air pipe carried up in a partition.

might lap up under the eaves through the windows from a fire within. Plates 5 and 6.

Note: The most vulnerable point of attack for an exposure fire of this kind is under the eaves, for the heat banks up there and the woodwork is always highly combustible since never exposed to storms. With ordinary construction numerous cracks are almost certain to exist alongside the rafters communicating directly with the attic space which is usually difficult of access and liable to be filled with combustible material. It is therefore important that the space above the plate and between the rafters be filled as tight as possible. Where masonry walls are used they should extend up to the underside of the roof boards, or be fire-stopped as indicated.

8. **Cornices and Gutters.** Combustible cornices are always troublesome in case of fire. They catch fire easily, are usually dry and so burn freely, and a fire travels through them rapidly. Incombustible cornices are safest. Even though the framework be of wood, it is wise to cover the exterior surface with incombustible material where practical. Metal lath and cement plaster or stucco could be used on flat surfaces on underside of cornices.

Cornices built of wood or having wooden frames on rows of buildings, shall be either fully fire-stopped between each building, or shall be completely separated. Plate 7.

Note: It is a common occurrence for a fire in a row of dwellings to communicate to several buildings through the cornice; it is much safer to make them entirely independent and it is so recommended.

9. **Piazzas.** It is important that stud walls back of or over piazzas, should be fully fire-stopped in manner indicated in Plate 8.

Note: Fire chiefs report that fire from a burning piazza is frequently carried through stud walls to the attic or upper story of a house and becomes the cause of complete destruction of the building, which otherwise might have been saved.

10. **Sliding Doors.** When sliding doors are pocketed in partitions, such pockets should be completely fire-stopped at sides, top and bottom. Asbestos mill board, or plaster board is suited to this use. Plate 9.

11. **Wainscoting.** The surface of the walls or partitions behind wooden wainscoting and dados, shall be plastered flush with the grounds and down to the floor line. The same stopping shall be placed behind all applied wooden trim, such as fancy wooden paneling.

12. **Stairs.** The space between stair carriages shall be fire-stopped by a header beam at top and bottom. Where a stair run is not all in one room, or where a closet is located beneath the stairs, the stair carriages should have an intermediate fire-stop, so located as to cut off communication between portions of the stairs in different rooms or between the closet and the room in which it is placed. Such stops can best be made of plank.

If a flight of stairs is so arranged as to be the only construction separating two stories at the place where they are located, as for example, between the cellar and the story above, the underside of the stairs should be covered with metal lath or ½-inch plaster board and plastered to a total thickness of ¾ inch.

13. **Ducts and Chases.** Ducts, chases, or shafts for pipes, wires, speaking tubes, and for similar purposes, shall be fire-stopped at each floor with mortar or other incombustible material so as to form tight joints.

14. **Water, Gas and Plumbing Pipes.** All exposed pipes passing through any floor or wall shall have the surrounding air space closed off at the ceiling and the floor line, or on each side of the wall by close fitting metal caps. Wherever possible they should be surrounded by mortar or other close fitting incombustible material which does not conduct heat like metal. In fire-proof construction it is preferable to have the pipes or shafts fit neat in the floor or wall. For protection around steam and hot water pipes, see Section 49.

15. **Hot Air Pipes and Registers.** Where a furnace hot air pipe passes through a floor, the space between the pipe and floor construction shall be filled with incombustible material supported by sheet metal or metal lath. A light porous material, such as mineral wool is best suited to the purpose. Plate 10, Fig. 3.

The space between a register box set in a floor and the casing protecting the floor construction, shall be filled with similar incombustible material. This shall include the space around that portion of the hot air pipe attached to the register box down to the bottom of the joists in wooden floor construction, and a layer of sheet metal shall surround the pipe and be securely nailed to the underside of the joists to support the fire-stopping. When a register box is fire-stopped in this manner, the space between the box and the casing may be reduced to 2 inches; otherwise it should be 4 inches as specified by Sec. 48, Par. 8. If the ceiling has a protective covering as elsewhere recommended, it should be made to cover the space and surround the pipe. Plate 10, Fig. 2. When a space of 4 inches is provided on all sides of a floor register box, and the surrounding woodwork is encased in metal, the fire-stopping might be omitted provided the cellar or furnace room ceiling be completely protected by a covering at least equal to the minimum grade specified in Sec. 38, and that this covering fit snugly around the pipe connection as indicated in Plate 10, Fig. 1. The fire-stopping would be more positive if the space were filled, and this is recommended wherever possible to obtain it.

When a register is connected to a brick hot air shaft, the space required between the outside of the shaft and the wooden floor construction shall be fire-stopped in like manner.

Note: This fire-stopping is important, but seldom done. Any such space should be fire-stopped irrespective of floor construction. In fireproof floor construction, register boxes should fit the floor opening snugly, and so make fire-stopping unnecessary. The protection of woodwork as elsewhere required around a register, will safeguard the wood from the heat of the pipe itself, but the open space provided around the pipe and register box forms an easy entrance for fire occurring in the lower story to gain access to the story which the register serves. The hot air pipe and its connections will get red hot and communicate fire to combustibles surrounding the register face, such as parquet floors, carpets, rugs and furniture. If the register box has soldered joints they will open, and a passageway for flame be formed. It is futile to enclose stairways and protect ceilings as elsewhere provided unless all other openings such as these are adequately closed.

The greatest hazard is in the cellar or basement where the furnace is located. There is an additional danger from the hot air pipes themselves. Such pipes leading from the furnace, if not protected would in case of a fire become intensely hot and burn the dust which invariably accumulates in such devices thus making a flash of fire, and there would be great danger of the fire being communicated to the floor above, even though the pipes and registers were fire-stopped at the floor openings. For this reason the pipes, and the furnace itself, should be fully covered with cellular asbestos or equivalent incombustible material at least ½ inch thick for the pipes, and 1 inch for the furnace. Such covering is inexpensive, and reduces coal bills by conserving the furnace heat. It is much used for this purpose alone. The covering is manufactured for the purpose and sold in rolls. It is ¼ inch thick, and should be used in double layers with broken joints. Suitable metal bands to hold it in place are supplied.

It is common practice to simply cover hot air pipes with a sheet of thin asbestos paper pasted to the pipe. Such protection is merely a pretense. It may have a little value as a heat insulator, but has practically none as a fire-resistant. It deserves no consideration.

16. **Chimneys.** See **Technical Letter No. 5.**

17. No fire-stopping should be in any manner concealed from view until opportunity has been given the owner or his representative to inspect same. This is particularly important when work is done under contract.

18. Although it would not be practicable to fire-stop an existing house as completely as here recommended for new construction, nevertheless it would be quite feasible to apply several of the suggestions to any existing house in which such barriers had been omitted, and would materially lessen the fire risk.

Note: The great obstacle in securing efficient fire-stops in a building, is in getting architects and builders to realize the supreme importance of such precautions. The ordinary carpenter or builder has an inherent prejudice against doing work which does not visibly advance his contract. Ignorant of the serious annual life and property loss due to fires in combustible dwellings, he considers the possibility of such a fire too remote to worry about, and the general experience is that he will not put in proper fire-stops unless very carefully watched. Someone must be responsible for rigid inspection to insure that such work is conscientiously performed. Usually the owner lacks experience, and does not know what should be required. It is hoped these explanations may be of assistance.

Section 38. Horizontal Cut-Off for Cellars.

2. The best possible cut-off is a fireproof floor. Such floors are a requisite for dwellings of Types I and II. They are equally applicable to dwellings of Type III, and to the highest grade buildings of Type IV, such as are often seen in city suburbs and on country estates. They should be used wherever possible, for they constitute a distinct safeguard. Such floors may be constructed of steel I beams with stone or cinder concrete, terra cotta, or other approved fireproofing between them with suitable protection for the bottom of the beams; or steel beams may be omitted, and the floor be constructed entirely of reinforced concrete; or a composite construction of reinforced concrete beams filled between with hollow tile, or metal or plaster forms with a concrete covering may be employed.

3. In buildings where steel beams are not otherwise used, it is probable that some variety of concrete floor construction would be the simplest and most economical. The forms could be easily supported, no hoisting of concrete would be necessary, and as the floor would be laid before the rest of the building was erected, all the form lumber could be used again for other purposes. In order to reduce the span and thickness of the floor slab, and thereby lessen the expense, the floor could be divided into panels by having beam supports at one or more intervals. A steel beam would be best suited to the purpose, but even a heavy wooden girder resting on brick piers, pipe-concrete columns, or substantial wooden posts, might be permissible if necessary.

4. Reliable building constructors state that such concrete floors can be built in most localities at practically the same price as first class wooden construction. Owing to the fact that the fire-proof floor is also waterproof, vermin proof, and thoroughly rigid, it would justify increased cost. If desired, a wooden finish flooring may be laid over the concrete. See Section 29, par. 2. The supporting beams under the floor, whether steel or wood, must be protected; the former by 2 inches of fireproofing, and the latter by at least ½ inch of metal lath and plaster, plaster board, or ¼ inch asbestos mill board.

Note 1: An unprotected steel beam when attacked by fire is not as reliable as a wooden beam. The reason is that steel loses its strength very rapidly when heated in excess of 500 to 600 degrees F., and such temperatures are easily attained in an ordinary fire. On the other hand a wooden beam of large cross section would burn fiercely over its whole surface, but the actual rate of penetration would be slow, consequently considerable time would be required for the beam to burn sufficiently to produce collapse even in a hot fire. This fact indicates the necessity for protecting steel beams, but does not warrant the substitution of wooden beams for steel. Other considerations may at times justify the use of timber construction instead of steel work, but unless protected by sprinklers, or covered with some non-inflammable material it adds to the fire hazard in the room in which it is exposed. If necessary to use a heavy wooden beam in a cellar as above suggested, it is recommended that if not protected by sprinklers, it be covered with metal lath and plaster, or with asbestos or plaster board. For sprinkler suggestions see Section 74.

Note 2. For the reason herein explained, it is necessary that all metal structural members used in dwelling house construction should be fully encased in fireproof material the same as would be required in other buildings.

5. In dwellings of Type III, where it may be impossible to secure the high degree of protection afforded by a fireproof floor for a cellar cut-off—also in frame dwellings of a grade which would not warrant the expense of such a floor—it is still very essential that efficient temporary protection be provided, and that every precaution be taken to prevent a cellar fire spreading to floors above, at least long enough to afford reasonable time to subdue it. This can be accomplished by protecting all communicating openings as elsewhere provided, and by covering the ceiling with fire-resistive material.

Section 49. Steam and Hot Water Pipes.

1. No steam or hot water pipe shall be within 1 inch of any woodwork. Every steam or hot water pipe passing through combustible floors or ceilings, or wooden lath and plaster partitions, shall be protected by a metal tube 1 inch larger in diameter than the pipe and be provided with a close-fitting metal cap on each side of the floor or partition. All wooden boxes or casings enclosing steam or hot water heating pipes, or wooden covers to recesses in walls in which steam or hot water heating pipes are placed, shall be lined with metal, and the pipes shall be kept at least 1 inch away from the walls of the box. Steam and hot water pipe coverings shall be of incombustible material.

2. Where steam or hot water pipes run horizontally parallel to joists and between floor and ceiling, they shall have metal supports, and the under side of the floor and the sides of the joists shall have metal protection; or the pipes shall be covered with incombustible pipe covering ¾ inch thick.

Note 1: There are two reasons for requiring the metal protectors for pipe above specified. First, to prevent fire following a pipe through a partition or wall. When a fire has heated the air and gases in a room to the temperature of combustion, they will pass through a very small opening and ignite any combustible material they touch. If such gases are under pressure, as is usually the case in a fire, the danger is increased. It must be understood that air or gases heated to the point of ignition of wood—which is less than 1,000 degrees F.—even though they carry no flame and are invisible, will set fire

instantly to practically everything combustible with which they come in contact. Second, the use of the metal sleeves protect woodwork from the heat of the pipes themselves. Steam pipes, even from low pressure boilers, will in time char wood in contact with them, and are liable to start a fire under favorable conditions. Cold water or other pipes should be sealed solidly into floors through which they pass.

Note 2: Where waterproof floors are provided, metal sleeves which encase steam pipes should extend a little above the floor level and be capped. This provides a dam to prevent water flowing to stories below, if from any cause the floor should become flooded.

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